

Industrial Energy Assessments

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University of Illinois

- Three campuses
- Total on-campus enrollment: 67,600
- Operating budget: \$2.7 billion
- Separately funded research: \$616 million

University of Illinois at Chicago (UIC)

- Total on-campus enrollment: 25,690
- Full-time employees
 - Faculty: 2,380
 - Administrative and professional: 2,971
 - Support staff: 5,364
- Operating budget: \$1.25 billion
- Separately funded research: \$234 million

Energy Resources Center (ERC)

- Created in response to the 1973 oil embargo
- ERC is a public service, research, and special projects organization
- Dedicated to improving energy efficiency and the environment across all markets
- ERC is a "fast response" team of professionals capable of quickly extending technical expertise, advice, and professional assistance
- Staffed by faculty, professional engineers, architects, economists and computer specialists

Energy Resources Center Research Groups

- Building Sciences Research
- Combined Heat and Power/Distributed Generation
- ***Engineering Solutions Group***
 - ***USDOE Industrial Assessment Center***
- Policy and Assessment Group

Engineering Solutions Group Overview

- Provide unbiased energy management solutions to Midwestern businesses and not-for-profits, state and local government
 - Energy conservation, energy supply chain management
 - Waste minimization and productivity solutions
 - Industrial, commercial, and institutional clients
 - Currently expanding to a national presence

Need for Energy Management

- Three Major Issues
 - Economic Competitiveness
 - Reduce commercial/institutional/governmental energy use
 - Reduce production costs and industrial energy use
 - Energy Security
 - Reduce oil and other energy imports (natural gas)
 - Reduce vulnerability to “shortages” of oil
 - Environmental Quality
 - Issues of global warming, acid rain, ozone depletion, etc.

Statistics

- US Energy Consumption (EIA Annual Energy Review-1998)
 - Industrial 35%
 - Commercial/Residential 34%
 - Transportation 27%

EIA-MECS DATA 1998

	Electricity	Natural Gas
Indirect Process Use	Million kWh	BCF
Boiler Fuel	5,568	2,471
	Electricity	Natural Gas
Direct Process Use	Million kWh	BCF
Process Heat	103,299	3,104
Process Cooling	54,473	21
Machine Drive	457,344	96
Electrochemical	87,200	n/a
Other Processes	3,380	51
TOTAL	705,696	3,272

EIA-MECS DATA 1998

	Electricity	Natural Gas
Non-process Direct Use	Million kWh	BCF
Facility HVAC	79,355	392
Facility Lighting	61,966	n/a
Other Facility Support	14,338	39
On-site Transportation	1,380	5
Electrical Generation	n/a	204
Other	696	n/a
TOTAL	157,735	640

Assessment Overview

- Energy Audit Goals
 - Identify the types and costs of energy used
 - Identify opportunities that reduce energy use (energy costs)
 - Conduct economic analyses on opportunities to determine cost effectiveness (ROI, ROR)
 - Recommend implementation strategy
 - Recommend implementation financing
 - Measurement and verification (Cx)

Energy Savings Opportunities

- No-cost and maintenance issues
 - 2 to ? percent expected savings
- Low-cost/short payback actions
 - 5 to 15 percent expected savings
- High-cost/longer payback actions
 - 15 to ? percent savings

Top 5 Requirements for Success

- Management commitment to EM
- Staff cooperation (willing to learn)
- Management willing to invest in energy projects
- Time and budget available to conduct energy assessments
- Implementation strategies

Industrial Assessment Methodology

- Acquire 12 months of energy bills and basic information about the plant
 - Electricity
 - Natural gas
 - Operating schedule
 - Equipment list
 - Energy concerns and actions taken to date
- Analyze bills and information
 - Seasonal usage patterns
 - Operational usage patterns
 - Calculate avoided energy costs
 - Puts upper limit on what can be saved

Industrial Assessment Methodology

- Plant assessment
 - Initial sit down
 - Walk through
 - Get familiar with production flow and systems
 - Identify energy users and their locations
 - Consolidate ideas
 - Breakout
 - Collect data
 - Take static measurements
 - Install monitoring equipment

Industrial Assessment Methodology

- Initial questions to plant management
 - Current/future operations
 - Impending changes
 - Thoughts and ideas
 - Their “wish list”
- Continue data collection
- Debrief plant management

Industrial Assessment Methodology

- Basic energy using systems
 - Compressed air and the associated distribution system
 - Motors
 - Lighting
 - HVAC/building pressurization
 - Boiler/steam system

Industrial Assessment Methodology

- Other energy using systems
 - Refrigeration
 - Melting furnaces
 - Process ovens
 - Cracking towers
 - Welding

The UIC-IAC

- Since FY00
 - Currently working on fourth year
- 82 assessments to date
- 16 general industry groups assessed
- Over 700 recommendations made
- Goal is to save client at least 10% of total energy budget within their capital investment guidelines

UIC-IAC Results FY2001 - FY2002

- Conducted 48 assessments
- Identified 383 savings opportunities
- On average, each assessment
 - \$275,000 in savings opportunities
 - Implementation cost of \$295,000
 - Simple payback of 13 months
- 159 of the 351 recommendations implemented (~45%)

UIC-IAC Results FY2001 - FY2002

- Recommendations per assessment day (energy only)
 - Average savings: \$60,000
 - Implementation cost: \$100,000
 - Simple payback: 1.7 years
- Recommendations per assessment day (energy, waste and productivity)
 - Average savings: \$254,000
 - Implementation cost: \$260,000
 - Simple payback: 1 year

Industrial Programs-Non IAC

- Improve E2, P2 and productivity in within Chicago's industrial base
 - Increase efficiency
 - Retain business within city
- Provided funding for assessments and implementation projects
- Program started in January 2001
- Targeted Metal Casting industry first
 - One of the most energy intensive industries
- 17 assessments completed

Industrial Programs-Non IAC

- Predicted savings in the Metal Casting industry
 - \$3.5M in cost savings identified
 - 45% in energy efficiency opportunities
 - 43% in productivity improvement opportunities
 - 12% in waste reduction opportunities
- Implementations continuing
- Assessment work continuing in the Chemicals industry and the Food and Kindred products industry
 - Implementation projects started for Chemicals industry

Industrial Programs-Non IAC

- State of Illinois Industrial Programs
 - Improve E2, P2 and productivity in within State's industrial base
 - Increase efficiency
 - Retain business within State
- Industries studied since 1996
 - Plastics, Metal Fasteners, Chemicals, Foods, Metal Casting, Paperboard

Industrial Programs-Non IAC

- Continuation of State Programs
 - New administration
 - Targeting 10 economic development areas
 - Multi year program starting in FY05
 - “Thousands of audits”
 - “Greater than 50 percent implementation rate”

Energy Conservation Success Story

- Primary metals manufacturer
- Major energy user is a natural gas furnace with no pre-heated air
- Recommended a two-pass heat exchanger for furnace exhaust
 - Returned 1,600°F air to furnace
 - Predicted energy use reduction of 35%
 - Predicted annual savings of \$197,000
 - Predicted investment payback of less than two years
- This hardware is in the budget for purchase

Energy Conservation Success Story

- Chemical facility with 102 steam traps failed in the open position
- Boiler operating at ~83-85% efficiency (new equipment)
- Steam system operating at 175 psig
- Annual natural gas, water and chemical treatment savings of \$154,000
 - 40,000 MMBtu in natural gas
 - Replacing steam traps with new units cost \$26,000
 - Simple payback just over two months
- This project has been installed

Energy Conservation Success Story

- Facility using two 150 hp screw compressors
 - Operating in tandem with no air storage
 - Compressors not communicating with each other, both attempting to service same loads
 - Recommend adding air storage and sequencing controls
- Compressors operating as “base” and “trim” units with trim in load/unload mode
- Annual energy and demand savings of \$14,000
- Simple payback in 2.3 years (budgeted)

Conclusions

- Energy waste is ubiquitous in all markets
 - Unnecessary and costly
 - Prudent energy conservation opportunities are available and real
 - Virtually all plants can take advantage of at least NC/LC opportunities
 - Many MC/HC opportunities fall within MARR of industrial plants
 - Doing nothing is not an option as energy costs in a deregulated market cannot be ignored

Industrial Energy Assessments

Questions?